

# Circulation and Respiration

Oct 30-8:22 PM

## Learning Objectives:

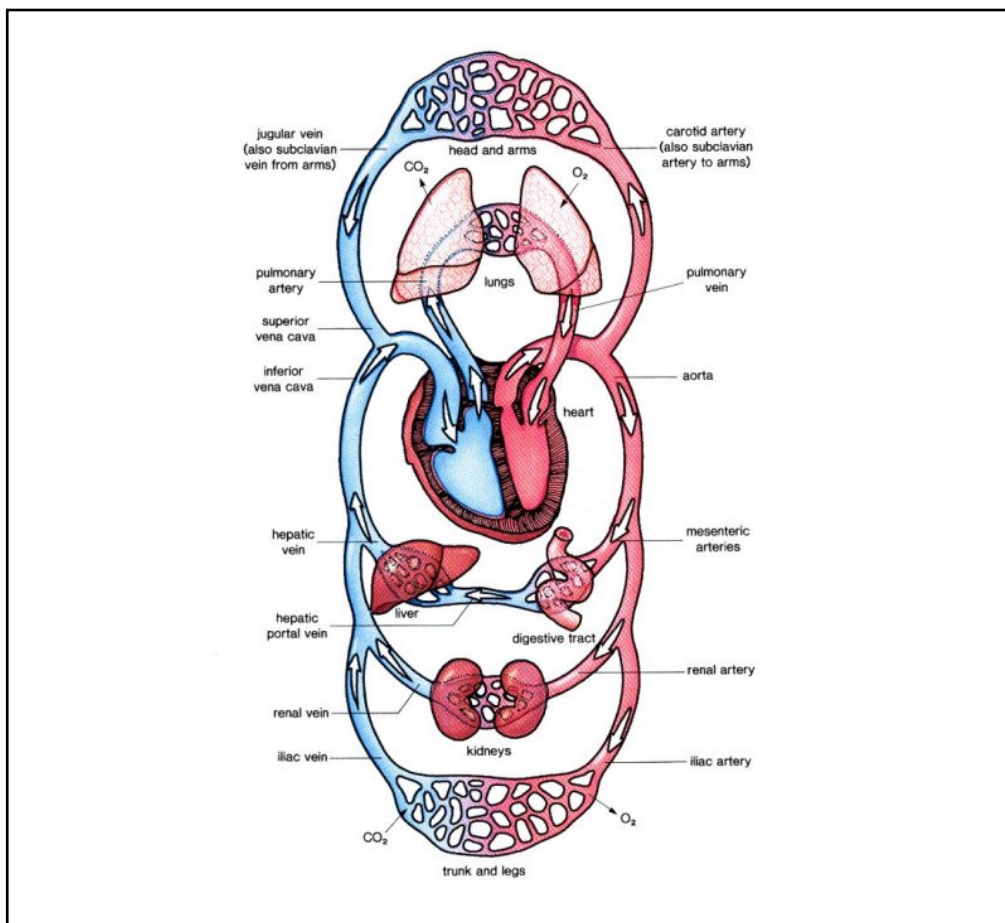
1. Explain the function of the human circulatory and respiratory systems and how they interact.

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The function of the circulatory and respiratory system is two-fold:

- 1) the respiratory system supplies the blood with oxygen
- 2) the circulatory system delivers the oxygenated blood to all parts of the body

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Nov 19-9:01 PM

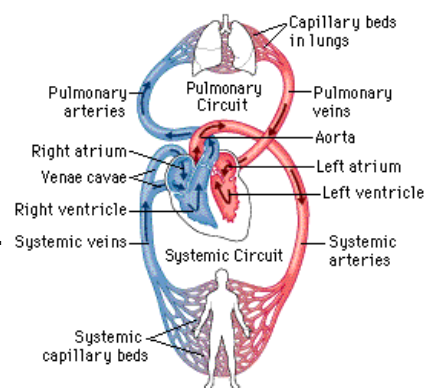
## Learning Objectives:

1. Trace the flow of blood through the heart, describe the pulmonary and systemic pathways, and the flow through the complete cycle.
2. Describe the structure and function of an artery, a vein and a capillary.
3. Identify and explain the role of leukocytes, erythrocytes, platelets, and plasma.

Nov 19-9:04 PM

## The Circulatory System

Can be divided into three primary cycles.



- 1) **cardiac circulation** - the route of blood in the heart
- 2) **pulmonary circulation** - pathway of blood from the heart to the lungs and back
- 3) **systemic circulation** - route from the heart to the rest of the body (includes all the blood vessels other than those in the lungs)

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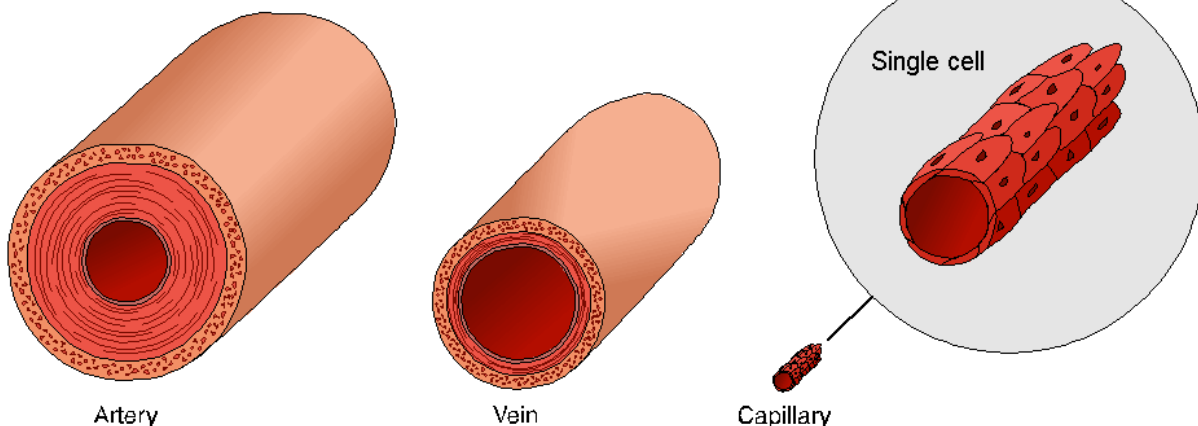
### 3 Main Elements of the Circulatory System

1. **Transport Vessels** - Blood Vessels - conduct fluid (arteries, veins, and capillaries)
2. **Transport Medium** - Blood - specialized fluid that carries substances around the body
3. **Pumping Mechanism** - Heart

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### Blood Vessels

There are 3 types of blood vessels



**ARTERIES** take blood away FROM the heart (arteries=away)

**VEINS** take blood TO the heart

**CAPILLARIES** connect the veins and arteries. They are the *smallest* blood vessel.

- most arteries carry oxygenated blood and most veins carry deoxygenated blood (Exception Pulmonary Artery and Pulmonary Vein)

Blood vessels



Vessel	Artery or Vein	Associated Organs
Aorta	Artery	Principal arteries of the body, distributing to all organs
Carotid	Artery	Head region
Jugular	Vein	Head region
Hepatic	Both	Liver
Renal	Both	Kidney
Vena cava	Vein	Principal veins of the body, collecting from all organs
Celiac	Artery	Serves Coelom (major body cavity) and contained organs (eg. stomach)

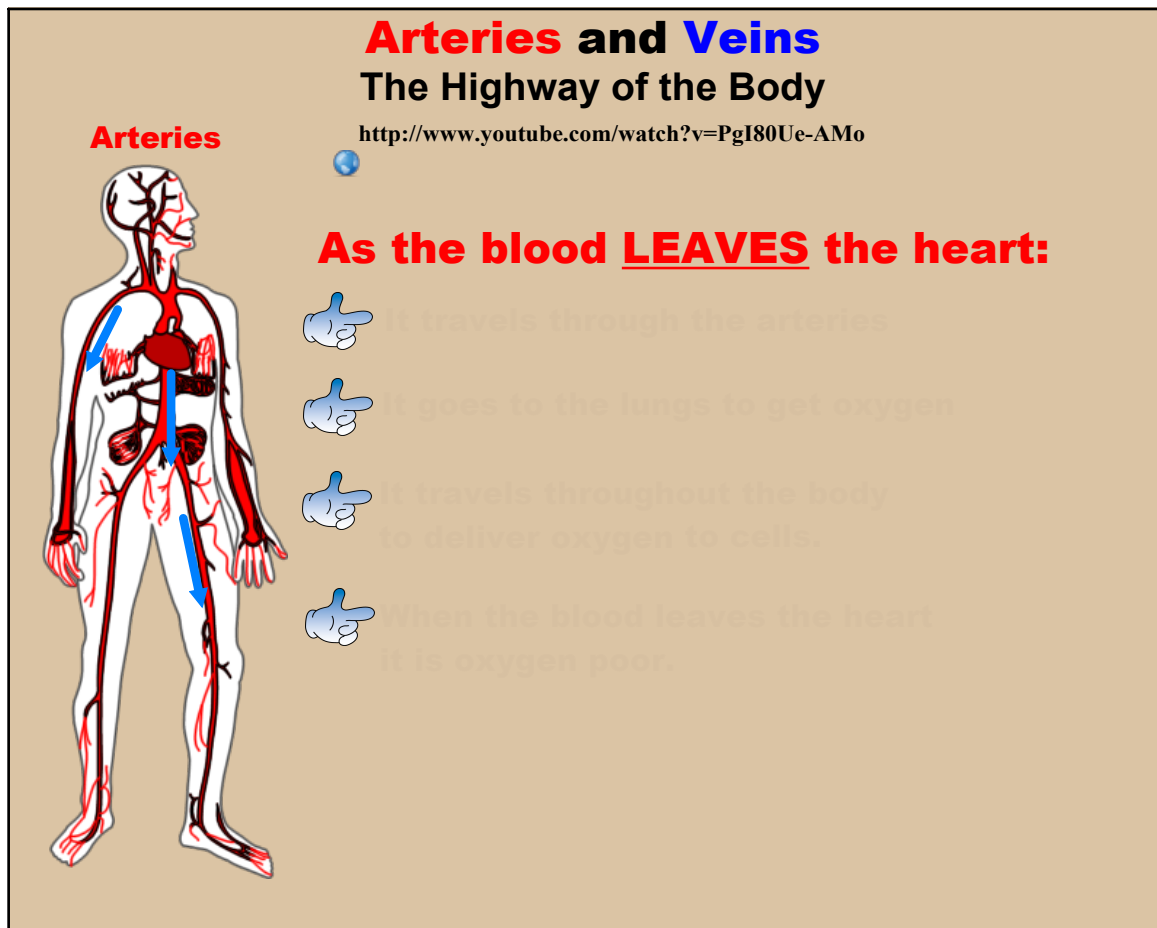
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## Blood Flow

Arteries → Arteriole → Capillary Network → Venules → Veins

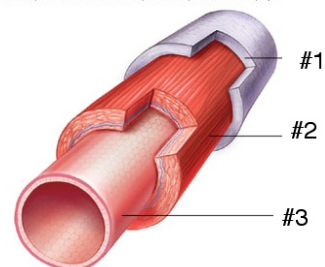
- It is in the capillaries that gases, nutrients, waste, and hormones are exchanged across capillary walls between the blood and the interstitial fluid bathing each cell of the body.

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Arteries

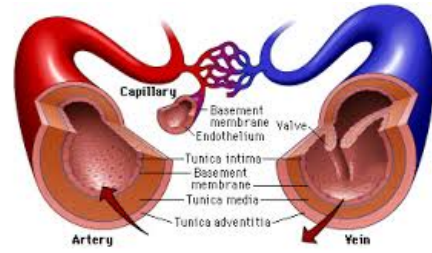
## Arteries



- Have 3 different structural layers:
  - Outer layer - covering of connective tissue with elastic fibers
  - Middle layer - thickest and made up of elastic bands and smooth muscle
  - Inner layer - made up of one layer of epithelial cells to reduce friction as blood flows
- the elasticity of the artery allows it to expand and snap back as blood passes through it (creates an additional pumping action)
  - this is what you feel when you measure your pulse.

## Veins

- has thinner walls than an artery but a larger inner circumference
- lack the elasticity of the artery but has a greater capacity (contains 2x amount of blood as arteries)
- they don't have an internal pumping mechanism to move blood back to the heart
  - veins above the heart rely on gravity
  - veins below the heart rely on muscle contractions to exert pressure on the vein
  - veins are equipped with valves to prevent blood from flowing backwards



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## Arteries and Veins

The Highway of the Body

**When the blood travels back TO the heart:**



It travels through the veins



It got oxygen from the lungs



The blood is oxygen rich.

## Veins




Veins


## Capillaries

- single layer of cells
- average size is 8 microns - size of largest blood cell
- allow for the movement of materials into and out of the blood



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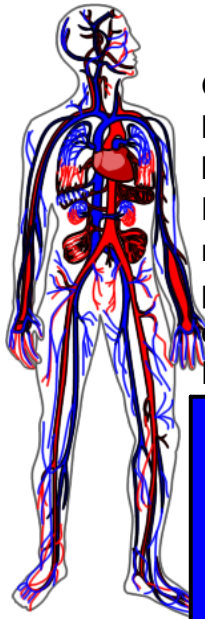
Sort the keywords so that the word is next to the correct definition.



Word	Description
AORTA	The smallest blood vessel. It connects the veins and the arteries.
VALVE	The longest and biggest blood vessel in the body.
ARTERY	The blood vessel that takes blood away FROM the heart.
CAPILLARY	The blood vessel that takes blood back TO the heart.
VEIN	These open and close allowing blood to travel in only one direction.



Blood vessel Keyword match 2

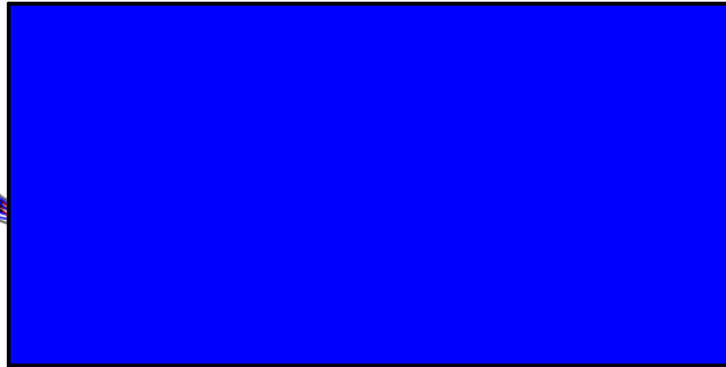


## Experiment with Blood:

Question: What are the main components of blood and are the ratios of components evenly balanced?

Hypothesis: Blood consists of four components: red blood cells, white blood cells, plasma, and platelets. The consistency of components is not evenly balanced.

Experimentation: Click on the body

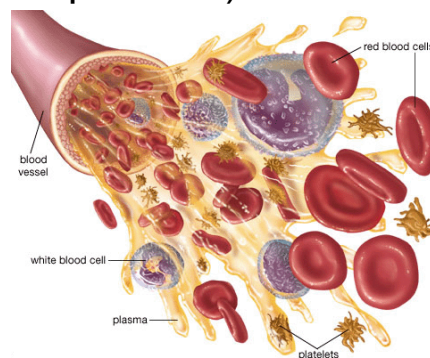
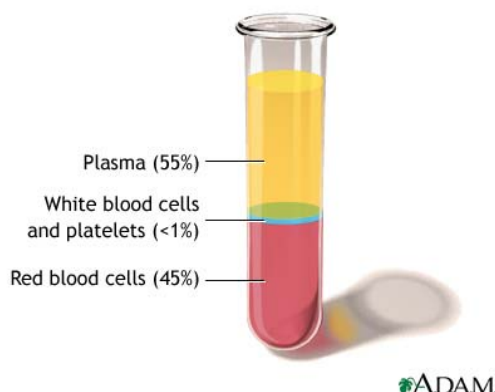


Resource: <[http://www.education.com/activity/article/Components\\_Blood/](http://www.education.com/activity/article/Components_Blood/)>

Blood Experiment

## Blood - The Transport Medium

- consists of two distinct elements:
  - fluid portion = plasma (55%)
    - made up of water, dissolved gases, proteins, sugars, vitamins, and minerals
  - solid (formed) portion = cells (red blood cells, white blood cells, and platelets)



**Red Blood Cells**

(44% of blood)

(Erythrocytes)

- specialized for oxygen transport

- have hemoglobin (has iron which bonds with oxygen) instead of a nucleus

**White Blood Cells**

(Leukocytes)

(1% of blood)

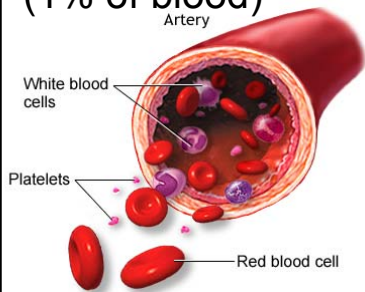
- specialized to fight infections

- made up of macrophages and lymphocytes

- have a nucleus and appear colorless

- macrophages are phagocytes (can pass through the walls of capillaries to engulf pathogens)

- lymphocytes are a part of the immune response - recognize and fight pathogens

**Platelets**

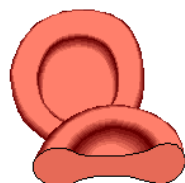
- fragments of cells that play a role in clotting

- release chemicals that react with plasma to create thromboplastin which reacts with various enzymes to create fibrin (a mesh that traps escaping blood) which results in a clot

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**Blood Cells****RED BLOOD CELLS**

carry nutrients and oxygen to the body.



Red blood cell

**PLATELETS**

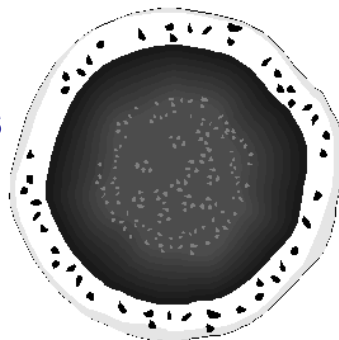
clot your blood and form a scab when you cut yourself.



Platelets

**WHITE BLOOD CELLS**

help fight infections when you are sick.



White blood cell

0.5 mm

Blood cells

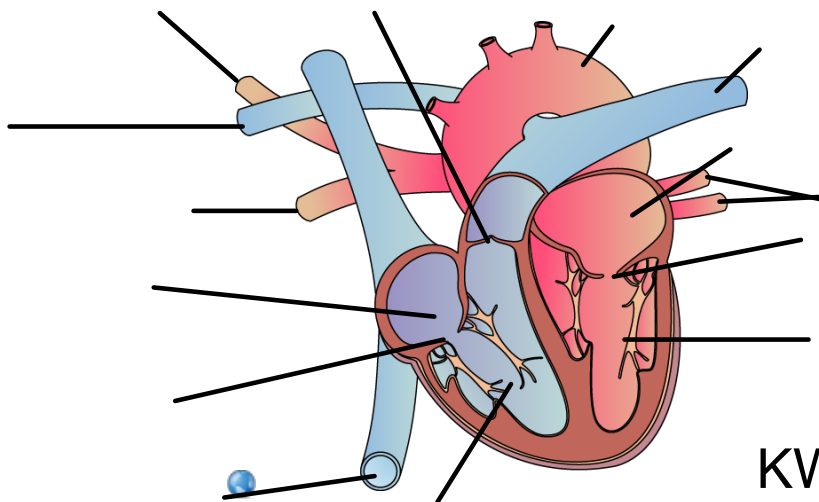
## The Engineers Job

Create a pump that will meet the following specifications:

- must work constantly day and night
- pump about 70 times per minute (90 000 times/day)
- with each pump it must move fluid through 160 000 km of vessels
- maintain a steady flow (without conscious control)
- must be able to meet instantaneously demands for an increase or decrease in the fluid pressure of the system
- pump in two directions at once without mixing the fluids
- life expectancy of roughly 80 years without major repairs or part replacements
- must be the size of your fist

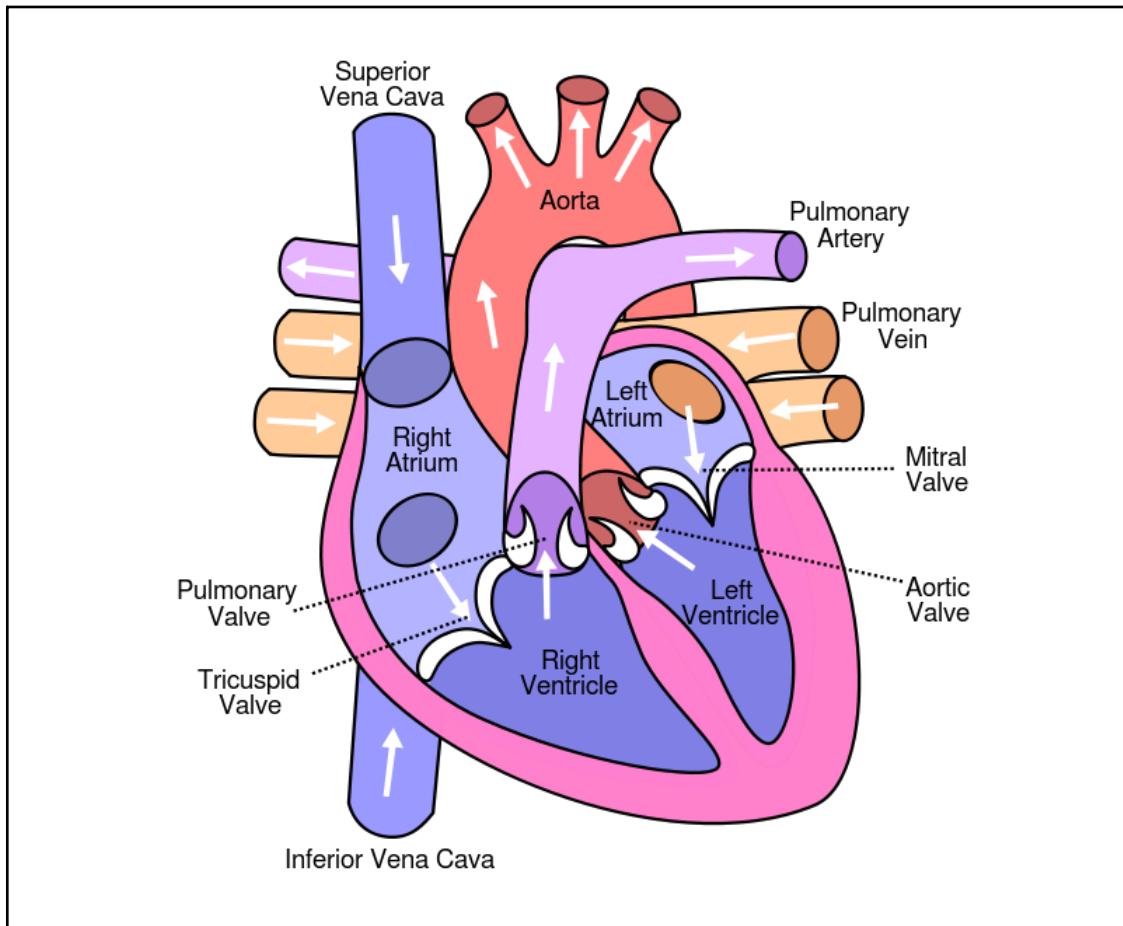
Nov 20-8:56 PM

## The Heart



KWL Label:

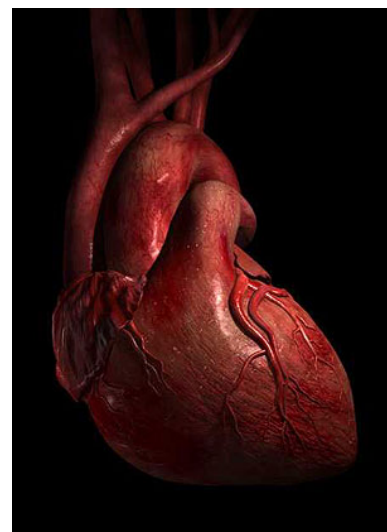
KWL



Oct 30-8:54 PM

## The Mammalian Heart

- has four chambers: a right and left atrium, and a right and left ventricle
- blood enters the heart through the atria and leaves the heart through the ventricles
- the two atria contract simultaneously, and the two ventricles contract simultaneously shortly after
  - double pump action!!

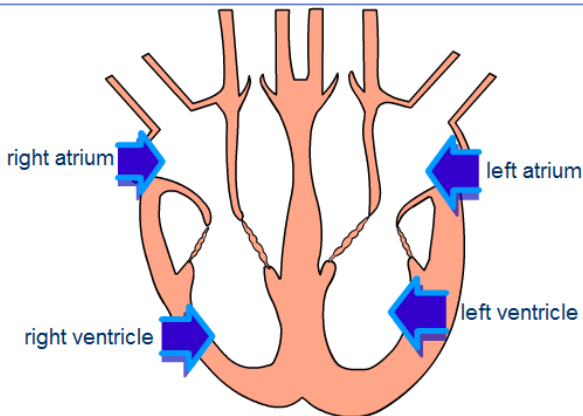


Nov 19-11:13 PM



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The Structure of the Heart Scene 1 of 9



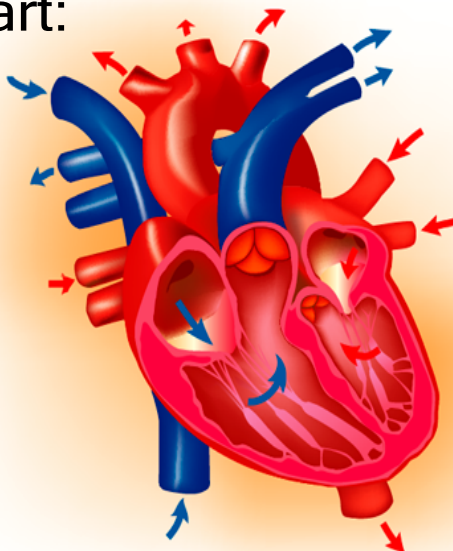
right atrium left atrium  
right ventricle left ventricle

The heart has four chambers.

SMART Supporting Education : intel

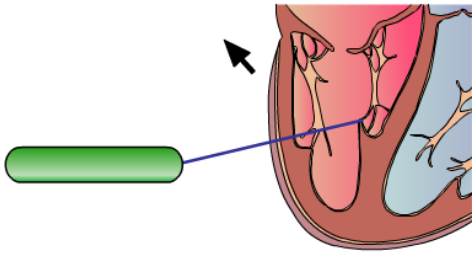
Heart Structure FLASH

Click the heart:



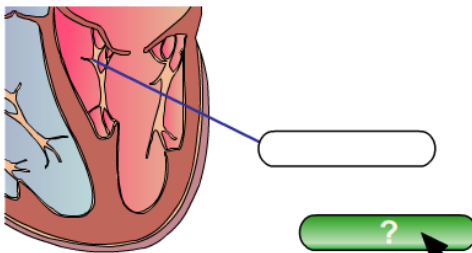
Heart Link

?



Click and reveal

SMART Technologies



Drag and drop

Choose the activity by selecting 'click and reveal' or 'drag and drop.'

Drop/Drag Heart

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Blood and Circulation

Reset ⓘ

Resuscitate

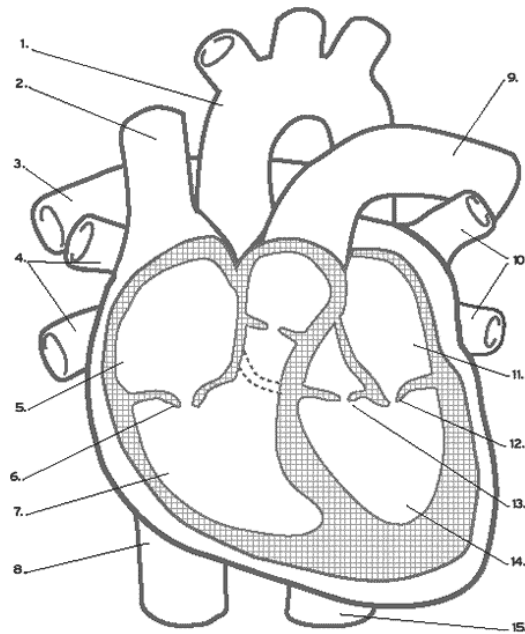
SMART Technologies

Supporting Education intel

Heart surgery

Exit Slip

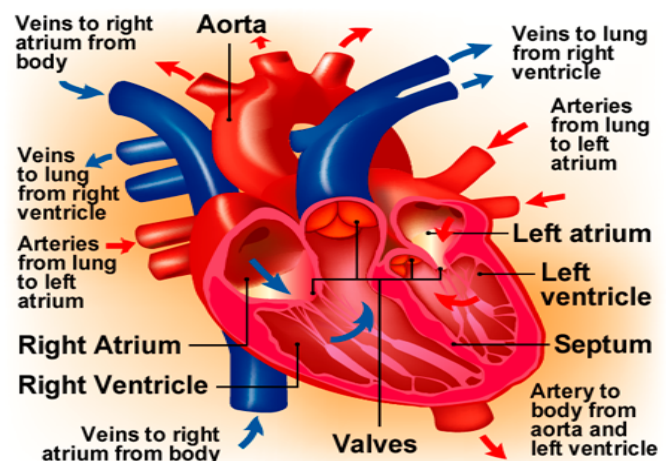
Fill in this diagram of the heart as much as you can and turn it in before you go.



Apr 20-8:53 PM

## From the Body to the Heart

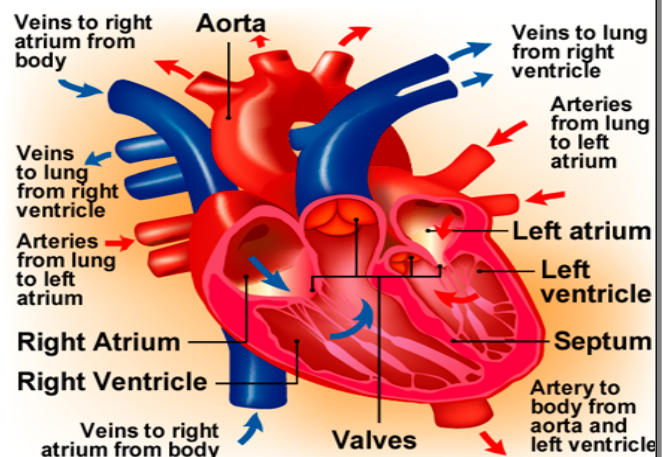
- blood is collected in the superior vena cava which flows into the right atrium
- right atrium pumps the blood into the right ventricle
- right ventricle contracts and pumps the blood into the pulmonary artery and then to the lungs



Nov 20-9:18 PM

## From the Lungs to the Heart

- oxygenated blood returns to the heart through the pulmonary veins and enters the left atrium
- atria contract and the left atrium pumps the blood into the left ventricle
- ventricles contract and the left ventricle sends the blood out through the aorta to the systemic circulatory system



Nov 20-9:50 PM

Re-arrange these sentences in the correct order to show the pumping action of the heart.

From the left atrium, the blood travels to the left ventricle through a valve

Blood travels through a vein to the left atrium

The left ventricle pumps the blood through the aorta out to the body to deliver oxygen

The cycle starts all over again


Blood travels to the right ventricle

Blood enters the right atrium chamber of the heart through a vein


The right ventricle pumps the blood to the lungs through an artery

Blood picks up oxygen from the capillaries of the lungs


Sentence arrange



Sort the keywords so that the word is next to the correct definition.



Word	Description
HEART	The state of blood when it leaves the heart traveling through an artery.
LUNGS	The upper chambers of the heart.
OXYGEN RICH BLOOD	The lower chambers of the heart.
VENTRICLES	A muscle in the body that acts as a pump.
OXYGEN POOR BLOOD	The state of blood when it leaves the lungs traveling through a vein.
ATRIA	The organ that provides oxygen to blood.



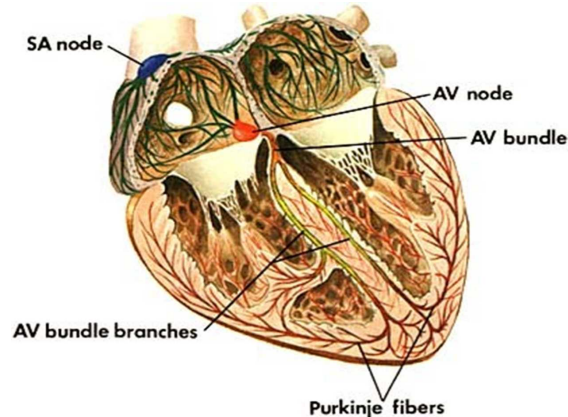
Heart Keyword Match

## Heart Valves

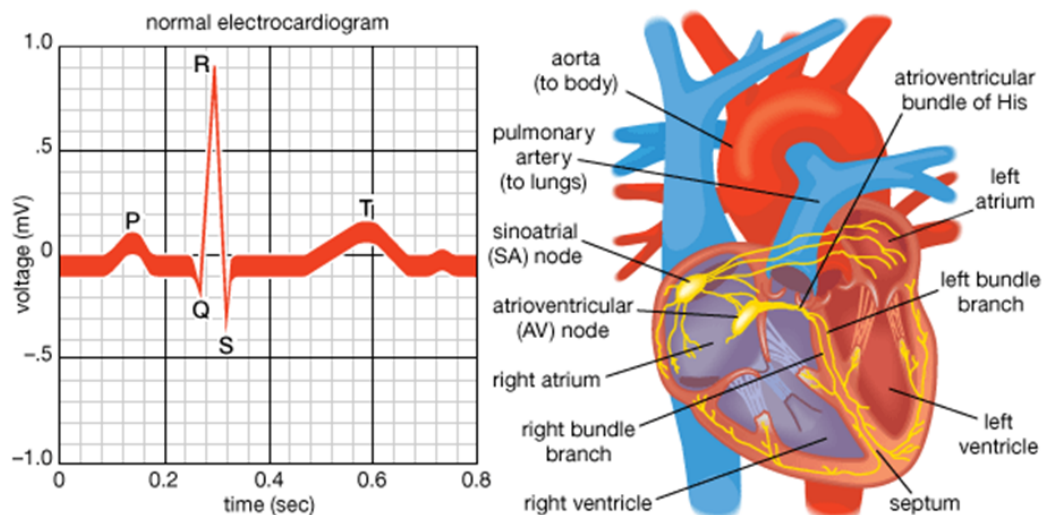
- valves prevent the back flow of blood during cardiac circulation
  - **bicuspid valve** separates the left atrium and left ventricle
  - **tricuspid valve** separates the right atrium and right ventricle
- between the left ventricle and the aorta and between the right ventricle and pulmonary artery are other valves (Aortic valve and Pulmonary Valve) to prevent blood from being sucked back into the heart
- the "lub-dub" sound you hear is caused by the opening and closing of these valves
  - lub - from values between atria and ventricles
  - dub - from values between ventricles and arteries

## Control of the Heart

- the impulse that triggers the heart to beat originates from electrical impulses released by the sinoatrial node (S-A node) located in the wall of the right atrium
- these impulses trigger the atrioventricular node (A-V node) which in turn stimulates the ventricles to contract
- the electrical signals can be measured using an electrocardiogram (ECG)



Nov 20-10:21 PM

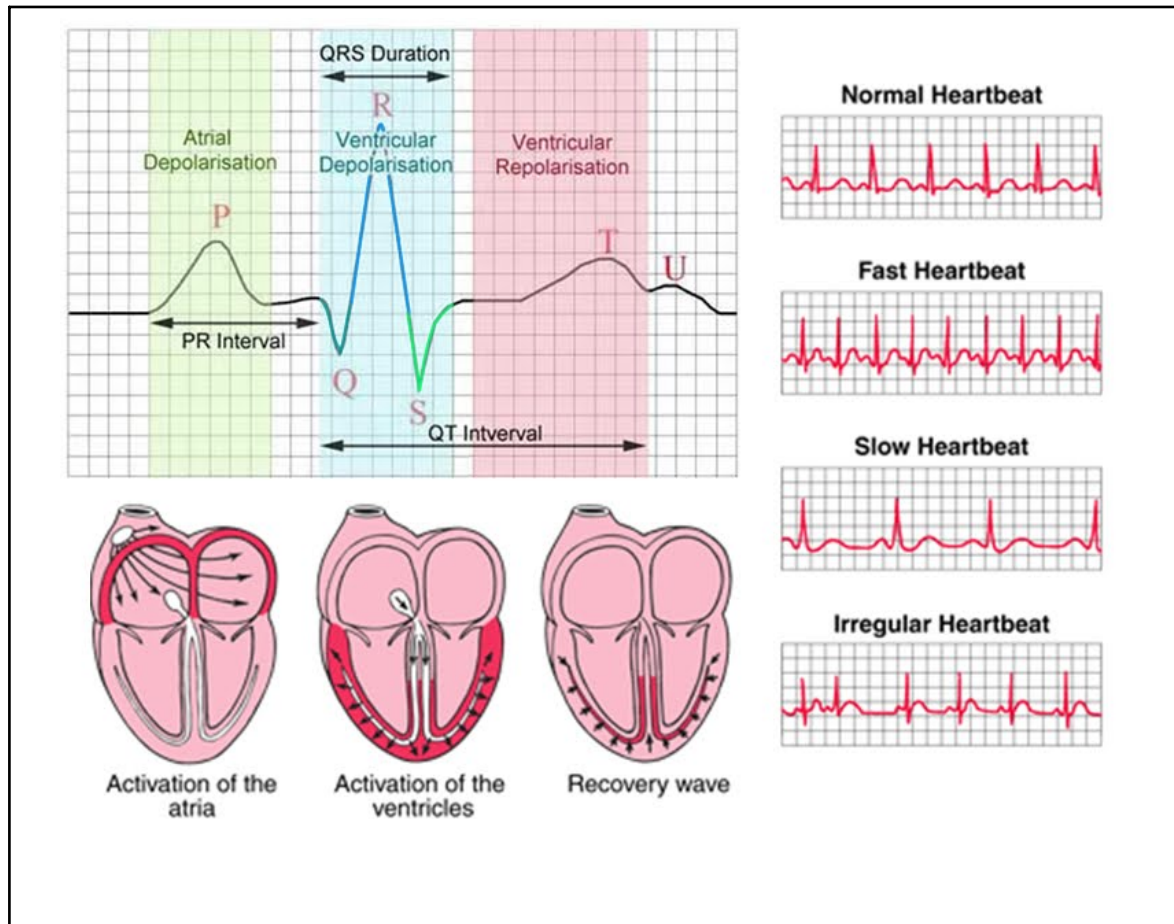


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- P wave – indicates the contraction of the atria
- QRS wave – indicates the contraction of the ventricles
- T wave – indicates the recovery phase as the heart prepares for the next contraction

Nov 20-10:38 PM





Nov 20-10:46 PM

## Blood Pressure

- Average blood pressure = 110/70
  - First number – Systolic Pressure
    - Represents the pressure exerted by your heart during each contraction
    - Measured in mm of Hg (mercury)
  - Second number – Diastolic Pressure
    - Represents the pressure exerted by your blood inside your blood vessels in between contractions.

Nov 20-10:54 PM

## Heart Attack

- Most heart attacks are caused by blockages (cholesterol) in the coronary arteries that feed oxygen to the cardiac muscle tissue.
- A heart attack causes sections of your heart muscle to die.
- The first indication of blockage might be Angina – chest pain sometimes misdiagnosed as heart burn
- Pain in the left arm may also be present
- Preventative procedures can help you avoid a heart attack

Nov 20-10:58 PM

## Treatments

### 1. Angioplasty

<https://www.youtube.com/watch?v=S9AqBd4RExk>



### 2. Bypass

<https://www.youtube.com/watch?v=3Nf6Q2skGOM>



Nov 20-11:02 PM





Apr 1-2:28 PM

Match the proper Word to its appropriate Description. When you are done, pull the "Pull" tab to check if your answer is correct.

Word	Description
<div>Pull</div>	Receives blood returning to the heart from all parts of the body.
<div>Pull</div>	Transports de-oxygenated blood from the right ventricle to the lungs.
<div>Pull</div>	The main veins that bring de-oxygenated blood from the body to the heart.
<div>Pull</div>	Receives blood from the Pulmonary Veins
<div>Pull</div>	The largest single blood vessel in the body. Carries oxygenated blood from the left ventricle to the body.
<div>Pull</div>	Receives oxygenated blood from the Left Atrium.
<div>Pull</div>	Transports oxygen rich blood from the lungs to the left atrium.
<div>Pull</div>	Receives blood from the Right Atrium

Left Atrium

Right Atrium

Pulmonary Artery

Left Ventricle

Aorta

Vena Cava

Pulmonary Vein

Right Ventricle

Mar 19-7:45 AM

Pair/Small Group Discussions:  
- Why is heart surgery important?

*Click the picture to perform Heart Surgery!*



Apr 20-8:48 PM

**Circulatory System Crossword**

4 2 3

1

5 6

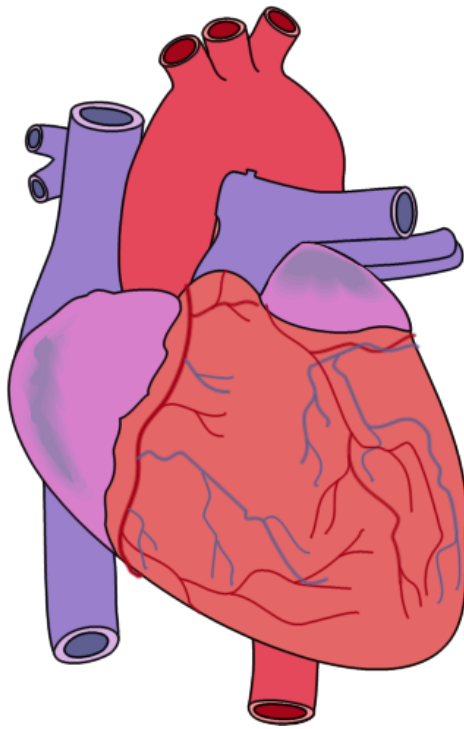
7 9 8

Clues

Solve

Reset

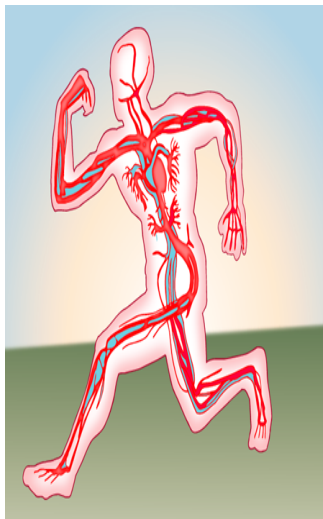
Crossword



Click on the heart to take a review quiz.

Oct 11-9:56 AM

## Experiment: Heart Rate



Question: Does heart rate increase due to activity?

Hypothesis: Heart rate will speed up with activity. Heart rate will slow down with inactivity.  
Experimentation: Click the body.



Heart Rate Experiment

## Circulatory Experiment



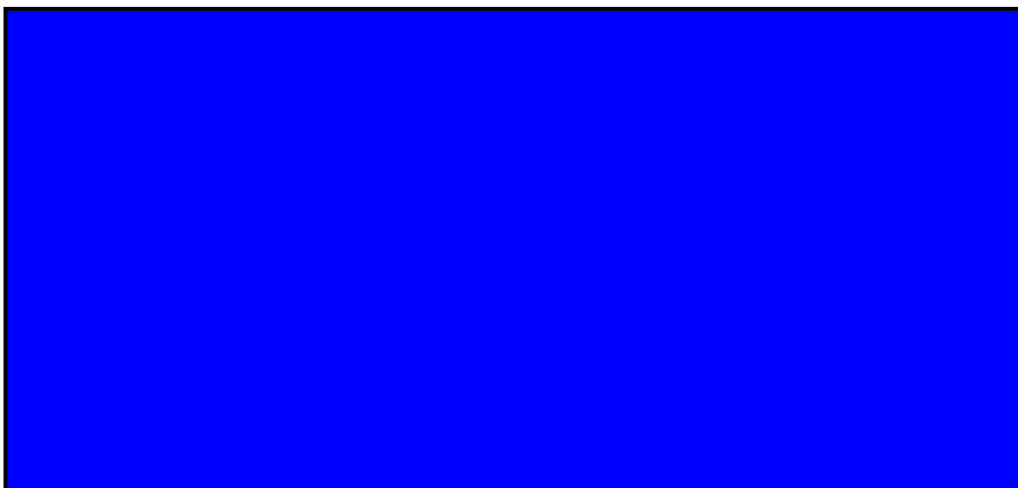
Question: How does activity affect a person's pulse rate?

Hypothesis: When a person is active for an extended period of time, his or her heart rate will become faster. When a person is inactive, his or her pulse stays slow.

Experimentation: Do several different experiments with people of the same age group. Take each person's pulse before & after each activity. Experiment with different lengths of time. (continued on the next page).

Oct 11-11:20 AM

Experimentation: (continued) For example, a running in place activity, you might see how one minute of running affects the pulse rate. After letting the person rest, see if two minutes affects them differently. Keep careful record of all your findings.



Oct 11-11:22 AM

# Circulatory System: Heart Rate

Activity	Time	Heart Rate

Oct 11-11:25 AM

## Circulation Word/Definition Match

- \_\_\_\_\_tissue made up of plasma & several types of cells
- \_\_\_\_\_vessels that carry blood from capillaries to the heart
- \_\_\_\_\_throbbing caused by blood rushing to the arteries
- \_\_\_\_\_organ that pumps blood to and from body cells
- \_\_\_\_\_tubes that form networks to carry blood
- \_\_\_\_\_tiny vessels that connect the smallest arteries & the smallest veins.

pulse

blood vessels

blood

veins

heart

capillaries

Matching

*It is expected that students will:*

- Investigate the structures and mechanics of respiratory system. (116-7, 212-6, 215-2, 213-5, 317-1)
- Design and carry out an experiment to investigate blood pressure, respiratory function or cardiac output under various conditions.

(212-6, 213-5, 214-9, 214-10, 215-2, 317-3)

- Describe disorders linked to the circulatory system and/or the respiratory system and their effect on the homeostasis of the system and the organism as a whole. (317-1, 317-3, 317-4, 317-6)

***Biology 111***

- Describe adaptive features that provide for efficient gas exchange in humans (116-7, 317-1)

***Biology 111 Optional***

- Predict the impact of environmental factors such as allergens on homeostasis within an organism.

Oct 30-8:22 PM

Click on the picture to link to a website to take a closer look inside . . .



Body Link

Nov 19-8:33 PM



The sentences are in the correct order to show the pumping action of the heart.



- 1** Blood enters the right atrium chamber of the heart through a vein
- 2** Blood travels to the right ventricle
- 3** The right ventricle pumps the blood to the lungs through an artery
- 4** Blood picks up oxygen from the capillaries of the lungs
- 5** Blood travels through a vein to the left atrium
- 6** From the left atrium, the blood travels to the left ventricle through a valve
- 7** The left ventricle pumps the blood through the aorta out to the body to deliver oxygen
- 8** The cycle starts all over again



Sentence arrange ANSWERS



## Definition match answers.



Word	Description
OXYGEN POOR BLOOD	The state of blood when it leaves the heart traveling through an artery.
VENTRICLES	The lower chambers of the heart.
HEART	A 4-chambered muscle in the body that acts as a pump.
ATRIA	The upper chambers of the heart.
OXYGEN RICH BLOOD	The state of blood when it leaves the lungs traveling through a vein.
LUNGS	The organ that provides oxygen to blood.



Heart Keyword Match answers